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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/687,947	10/17/2003	Yoshihiro Yuu	81863.0022	9929

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EXAMINER	
MRUK, GEOFFREY S	
ART UNIT	**PAPER NUMBER**
2853	

DATE MAILED: 08/10/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/687,947	YUU ET AL.	
	Examiner	Art Unit	
	Geoffrey Mruk	2853	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 July 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-25* is/are pending in the application.

4a) Of the above claim(s) *1-9 and 21-25* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *10-18 and 20* is/are rejected.

7)☒ Claim(s) *19* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *02 February 2004* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *2 February 2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

Claims 1-9 and 21-25 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 21 July 2005.

Drawings

Figures 4(a) and 4(b) should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

The disclosure is objected to because of the following informalities:

- Page 14 of the specification describes a non-constraint part 8a (line 1), a constraint part 8b (line 2), and a non-constraint part 8b (line 7). This is conflicting since a part (element 8b) cannot be constrained and non-constrained simultaneously.
- The unit of measure for the elastic compliance stated in the specification on page 17, lines 4-7 is inconsistent with the unit of measure for the elastic compliance stated in claim 18.

Appropriate correction is required.

Claim Objections

Claim 18 is objected to because of the following informalities:

The unit of measure for the elastic compliance stated in claim 18 is inconsistent with the unit of measure for the elastic compliance stated in the specification on page 17, lines 4-7. For examination purposes, the examiner will construe the unit of measure for the elastic compliance to be m^2/N.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 10, 11, 15 and 17 are rejected under 35 U.S.C. 102(e) as being anticipated by Kanno et al. (6,900,579 B2).

With respect to claim 10, Kanno discloses an actuator (Fig. 1) comprising a ceramic substrate (Fig. 1, element 6; Column 5, lines 36-37) and a plurality of displacement elements (Fig. 1, array of elements 1-4) disposed on the surface of said substrate, said displacement elements comprising a piezoelectric ceramic layer (Fig. 1, element 1) and a pair of electrodes (Fig. 1, elements 3 and 4) interposing there between said piezoelectric ceramic layer, said piezoelectric ceramic layer comprising a perovskite compound containing Pb, Zr and Ti (Column 3, lines 41-49), the lattice constant ratio c/a of said perovskite compound being 1.013 to 1.016 (Column 4, lines 49-57), said actuator having a thickness of 100 μm or less (Total thickness of elements 1, 3, 4 = 5.2 μm; Column 3, lines 46, 63; Column 4, line 7).

With respect to claim 11, Kanno discloses the perovskite compound is a lead zirconate titanate-based compound (Column 3, lines 41-49).

With respect to claim 15, Kanno discloses the ceramic substrate is a piezoelectric element (Column 5, lines 36-41)

With respect to claim 17, Kanno discloses the magnitude of d_{31} is 200 pm/V or more (Column 1, lines 57-66).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

1. Claims 12 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kanno et al. (6,900,579 B2) in view of Hasegawa et al. (US 5,719,607).

Kanno discloses the actuator with a piezoelectric layer (Fig. 1, element 1).

However, Kanno fails to disclose the piezoelectric ceramic layer contains at least one selected from Sr, Ba, Ni, Sb, Nb, Zn and Te and the piezoelectric ceramic layer contains Ba in an amount of 0.02 to 0.08 mol, and Sr in amount of 0.02 to 0.12 mol.

Hasegawa discloses "an extremely small amount of Ba, Sr, La, Nd, Nb, Ta, Sb, Bi, W, Mo, Ca or the like may also be incorporated into the piezoelectric film of either the two-component system or the three-component system. In particular, in the case of the three-component system, the incorporation of 0.10 mol % or less of Sr or Ba is favorable" (Column 5, 39-45).

At the time of the invention, it would have been obvious for one of ordinary skill in the art to combine the teachings of Hasegawa in the thin film piezoelectric element of Kanno. The motivation for doing so would have been "to improve the piezoelectric properties" (Column 5, lines 45-46).

2. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kanno et al. (6,900,579 B2) in view of Shimada et al. (US 6,097,133).

Kanno discloses the actuator with a piezoelectric ceramic layer that contains Pb. (Fig. 1, element 1; Column 3, lines 41-49).

However, Kanno fails to disclose contains Pb exceeding the amount of Pb required from the stoichiometric ratio of said perovskite compound, and the excess ratio at site A is 1.005 to 1.04.

Shimada discloses "An example of the binary PZT film formed by sputtering is a compound having the composition represented by the following chemical formula: $Pb(Zr_x\ Ti_{1-x})O_3$ +YPbO, wherein x is a number of from not less than 0.40 to not more than 0.6; and Y is a number of from not less than 0 to not more than 0.3" (Column 10, lines 16-24).

At the time of the invention, it would have been obvious for one of ordinary skill in the art to combine the teachings of Shimada in the thin film piezoelectric element of Kanno. The motivation for doing so would have been "to provide a thin piezoelectric film element having improved piezoelectric characteristics and a process for the preparation thereof" (Column 3, lines 6-9).

3. Claims 16 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kanno et al. (6,900,579 B2) in view of Qui et al. (US 6,142,615).

Kanno discloses an actuator (Fig. 1) with a constraint part (Fig. 1, interface between elements 2 and 6).

However, Kanno fails to disclose an adhesive layer to a part of said ceramic substrate, and displacement occurs at a non-constraint part and a printing head comprising a passage member having a plurality of ink passages such that the displacement element constituting the actuator is located immediately above the ink passage, ink charged in the ink passage being discharged by the displacement of the displacement element.

Qui discloses "Nozzle plates 1 are aligned and bonded, using resin, to the pressure chamber substrate 2 that has been etched, so that the positions of the nozzles 11 correspond to the locations of the cavities 21 in the pressure chamber substrate 2. The pressure chamber substrate 2 to which the nozzle plates 1 are bonded is attached to the housing 5. In this fashion, the ink-jet recording head 101 can be completed" (Column 12, lines 7-11). Qui also discloses "an ink-jet printer in which an ink-jet recording head according to the present invention is employed" (Column 5, lines 41-60).

At the time of the invention, it would have been obvious for one of ordinary skill in the art to combine the teachings of Qui in the thin film piezoelectric element of Kanno. The motivation for doing so would have been "to provide an ink-jet recording head that has a laminated structure comprising piezoelectric ceramic layers having different characteristics, so that a piezoelectric device can be formed which has a higher

piezoelectric constant d than a conventional device, thereby permitting more ink droplets to be ejected at a higher speed while applying a lower voltage" (Column 1, lines 44-50).

4. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kanno et al. (6,900,579 B2) in view of Hasegawa et al. (US 6,842,166 B2).

Kanno discloses the actuator (Fig. 1).

However, Kanno fails to disclose an actuator wherein elastic compliance is 14.0 x 10^{-12} m^2 /N or less.

Hasegawa discloses a piezoelectric transducer where "k_{ij} is the electromechanical coupling factor of the piezoelectric film layer 25; Q_m is the mechanical Q of the piezoelectric film layer 25; L_2 is the interval between the pair of second electrode layers 26 and 27; t is the thickness of the piezoelectric film layer 25; s_{ij}^E is the elastic compliance at an electrical field 0; and s_{ij}^D is the elastic compliance at an electric flux density 0. For example, in the case of 52 mole % lead zirconate-48 mole % lead titanate PZT, k_{31} =0.313, k_{33} =0.670, Q_m =860, s_{33}^E =17.1x10^{-12} m^2 /N, s_{11E}=13.8x10^{-12} m^2 /N, and s_{33}^D=9.35x10^{-12} m^2 /N. When L_2 =1μm and t=200 nm, a very high voltage amplification factor r=450 can be attained" (Column 5, lines 47-57).

At the time of the invention, it would have been obvious for one of ordinary skill in the art to combine the teachings of Hasegawa in the thin film piezoelectric element of Kanno. The motivation for doing so would have been "to form a miniaturized piezoelectric transducer" (Column 2, lines 18-19).

Allowable Subject Matter

Claim 19 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. The prior art of record fails to disclose an actuator wherein the maximum difference in composition ratio Pb/(Ti+Zr) between the surface of the piezoelectric ceramic layer and inside of the ceramic substrate is 0.02 or less.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Gilbert et al. (US 6,730,354 B2) discloses methods of forming ferroelectric PB(ZR,TI)O_3 films where "the precursor solution (liquid) Pb/(Zr+Ti) ratio preferably is between 0.3 and 3.0 (Column 7, lines 58-61).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Geoffrey Mruk whose telephone number is (571) 272-2810. The examiner can normally be reached on 7am - 330pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Meier can be reached on (571) 272-2149. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

GSM
8/3/2005

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8/5/05

MANISH S. SHAH
PRIMARY EXAMINER